How to Brainstorm, Develop, and Project Manage Ideas in Science: A Cheat Sheet
Jim Valcourt ~ Harvard Quantitative Biology Series ~ April 11, 2019

Generating Ideas

- There are two modes of idea generation: active ("brainstorming") and passive ("serendipity capture")
- Active brainstorming techniques try to bash concepts together in a weird way
  - TOOL x TOPIC brainstorming (silly version at jamesvalcourt.com/idea-generator)
    - List 10+ tools/approaches you know how to use
      - e.g. "microfluidics, Luria Delbrück, pulse chase, quantitative microscopy, single cell, mathematical model, compressed sensing, CRISPR screen"
    - List 10+ very broad topics/questions you might want to address
      - e.g. "Building better organoids," "How do new genes evolve?" "What are the sources of lineage bias in stem cell populations?"
    - Use a random number generator to pick a tool and a topic
    - Take the pairing "seriously but not literally"
    - Write for 30 seconds to a minute in silence. Don't let others in the group influence your ideas yet! Then have each person present their ideas.
    - You need to pass through a bad/ridiculous idea to get to a good one, or you would have found the good one already
  - WWMED ("What would Michael Elowitz do?")
    - Write down famous people in your field who have a distinctive style
    - How would they approach this problem?
    - Also called "Alternate worlds" in Design Thinking
- Passive "serendipity capture" techniques help you make the most of "Eureka!"
  - When an idea or topic tickles your brain in a weird way, write it down
  - Keep notes on your phone and periodically review
  - Cultivate calculated boredom (hiking, showering, yoga, walking to work)

Idea-to-project

- Questions to ask to help pick an idea
  - What is the best possible outcome? Is that result really exciting?
  - Are there uninteresting outcomes? Ideally all outcomes are interesting.
  - All projects are hard in some way, so don't necessarily pick the "easy" project. (But avoid impossible projects.)
- Project planning
  - Write down the big question
  - Break it into smaller, independent questions (do NOT have to be specific aims)
  - For each sub-question, write down on a Post-it every experiment you can think of that you might want to do
  - Give each experiment a time estimate
  - Identify dependencies among experiments and group by those
  - Importance / difficulty plot

Keep on track

- Fail fast
- What can I get done if I stay up all night? What *can't* I get done? (Do the latter.)
- What tools can you use? I don't have a great solution. Not many are designed for research.
  - Business uses Microsoft Project
  - Airtable, Trello, Asana… nothing is perfect
- Managing people
  - Tailor style to experience and personality
  - Communicate goals, not (just) tasks